2track separation study with GARFIELD++

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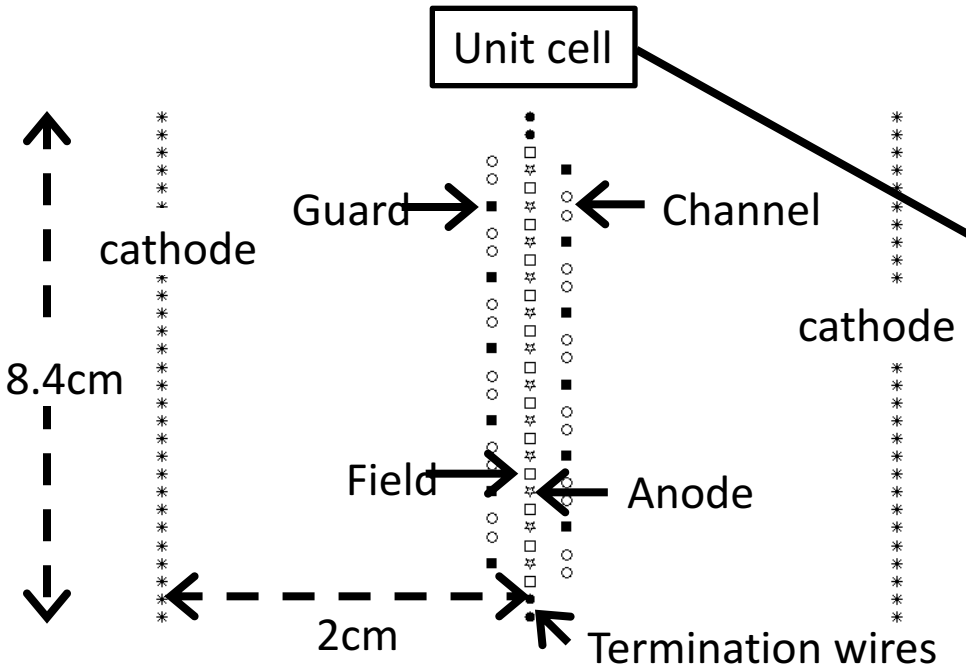
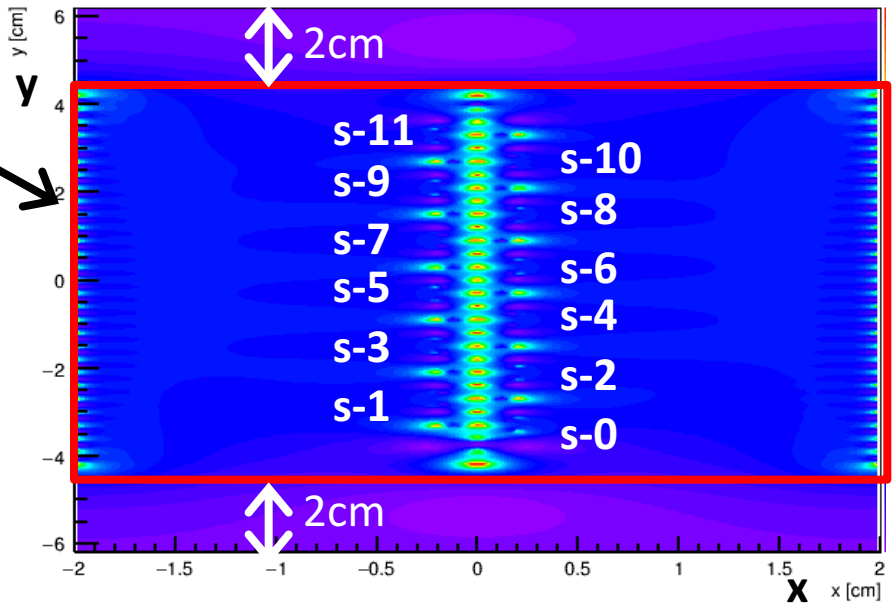
Setup (HV & Gas)

- HV configuration
  Anode: 0V, Cathode: -4500V, Field: -2600V, Guard: -800V, Channel: -1500V
- Gas: Ar-C_2H_6 (50:50)
  - ✓ Gas properties are calculated by Magboltz
- X: mirror periodicity, Y: GND at upper & lower boundaries
- Lorentz angle: OFF (on-going)



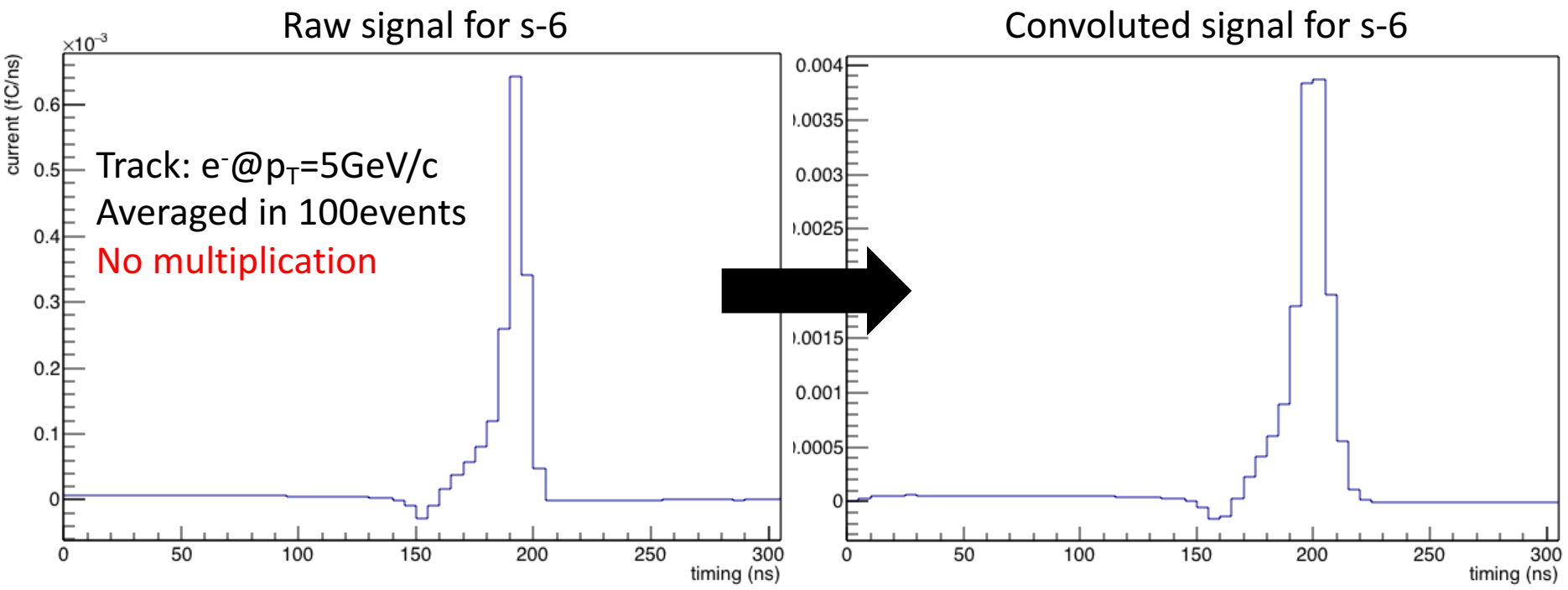
E-field in DC



Signal from anode wire

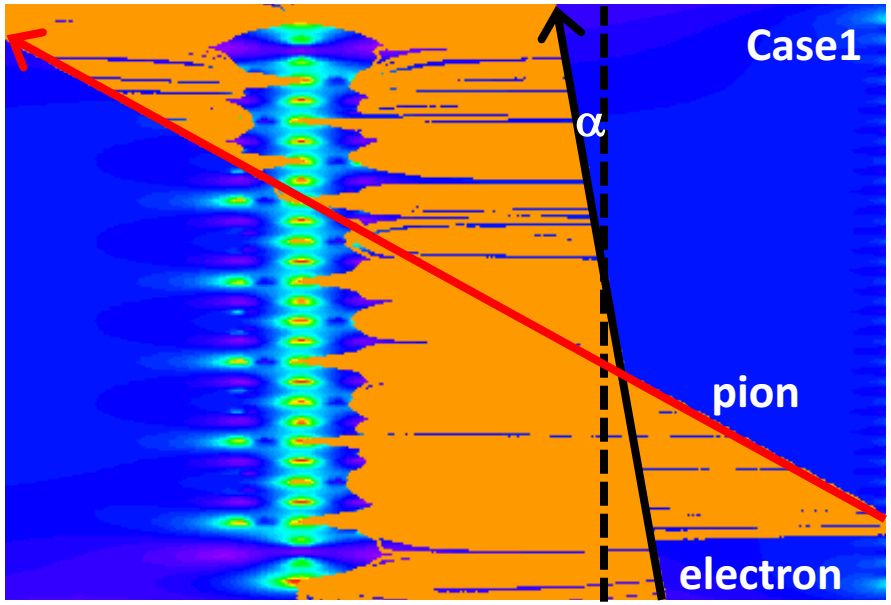
- Induced current, i(t) is calculated using Shockley-Ramo theorem
  - ✓ $i(t) = -q\mathbf{v} \cdot \mathbf{E}_w(\mathbf{r})$, q: charge, v: drift velocity
- Convolution with response function of shaping amp
  - ✓ $V(t)=(t/n\tau)^n e^{n-t/\tau}$

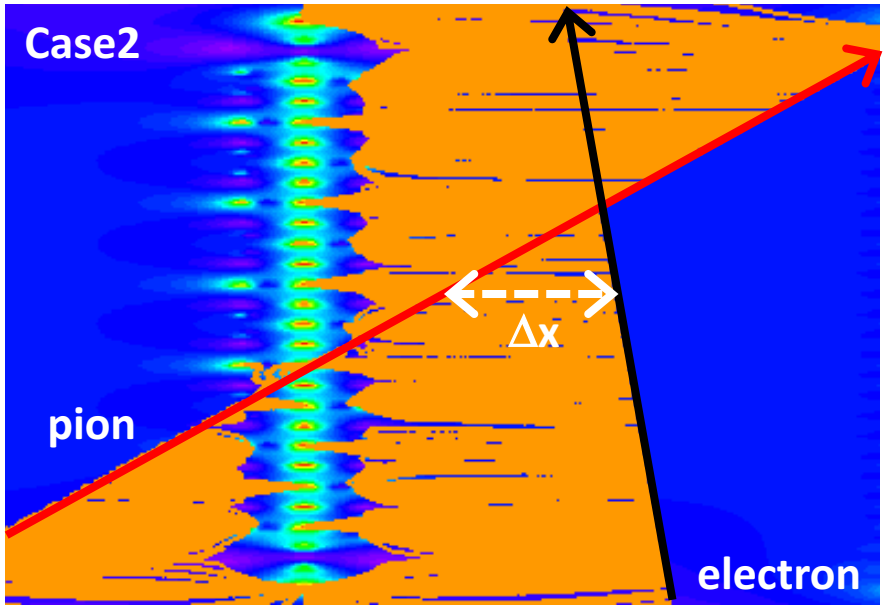
    t=2ns, n=3 from PHENIX DC electronics



2track simulation

- Input tracks
  - ✓ Signal: electron (p_T=5GeV/c, α=2deg)
  - ✓ BG: π (p_T=0.5GeV/c, α= +/-20deg)
  - ✓ Only drift electrons generated by ionization, no multiplication
- Electron track always passes at $(x_e,y_e)=(1,0.3)$, and p track at $(x_\pi,y_\pi)=(1-\Delta x,0.3)$.
  - ✓ Note: s-6 at $(x_{s\text{-}6},y_{s\text{-}6})=(0,0.3)$ [cm]
  - ✓ Variation of Δx : Δx = 0.08, 0.10, 0.12, 0.14, 0.16 cm

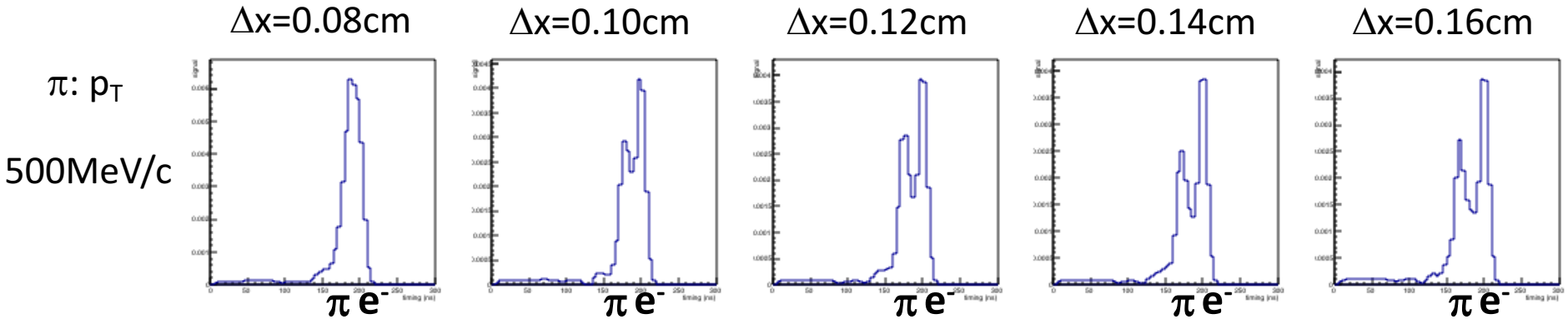




Peak finding

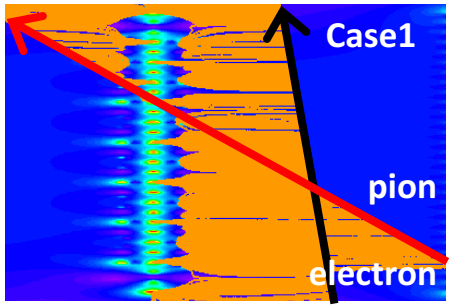
- Procedure of peak finding
  1. Peak finding using TSpectrum class
  2. Gaussian fit with peak positions from TSpectrum
     a. If npeaks==2, double Gaussian fit
     b. If npeaks==1, single Gaussian fit
        i. If peak width of fit > 7ns, double Gaussian fit

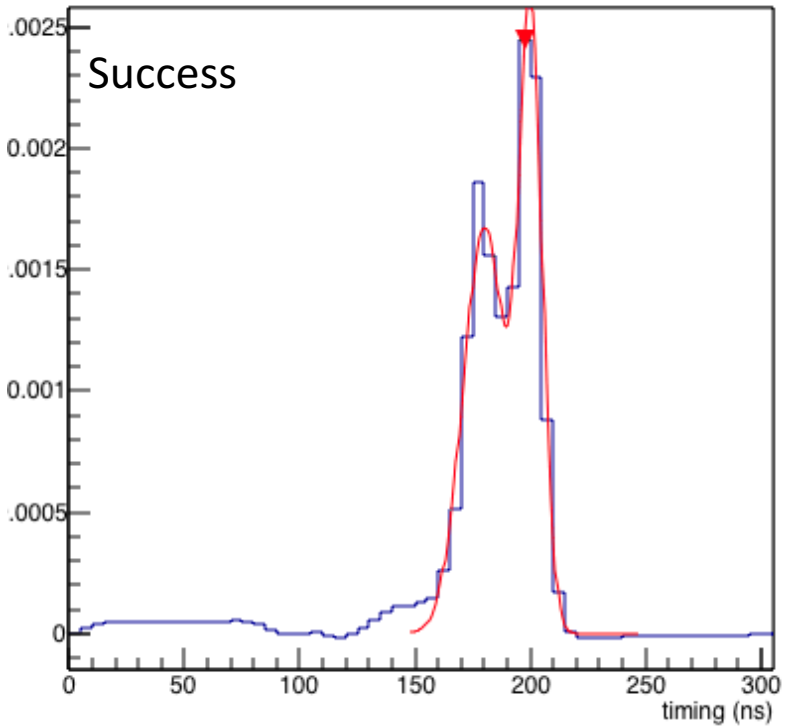
Averaged signal shapes of 2tracks at s-6

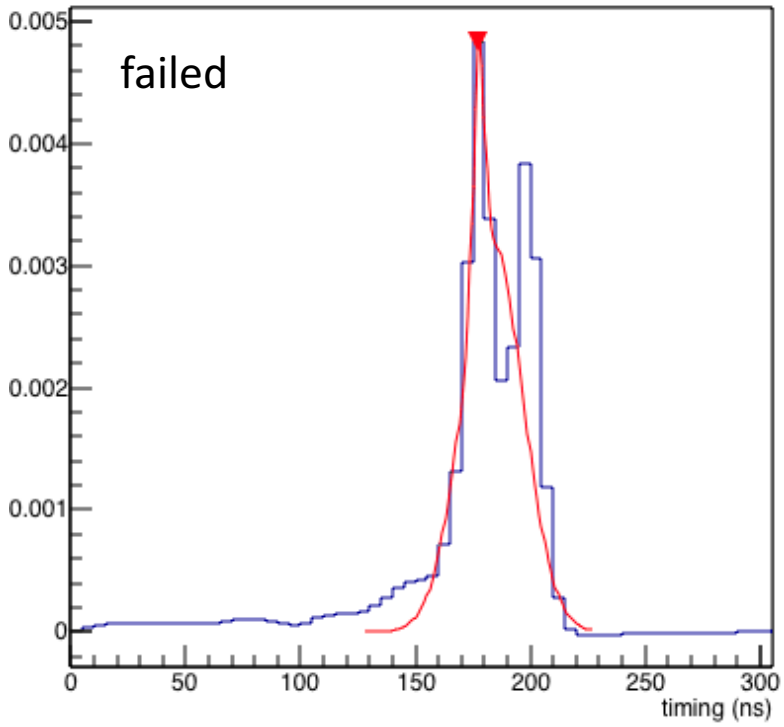


Examples of peak finding

- Examples of succeeded & failed events
  - ✓ BG: π, p_T=500MeV, Δx=0.10cm
  - ✓ Track trajectory :

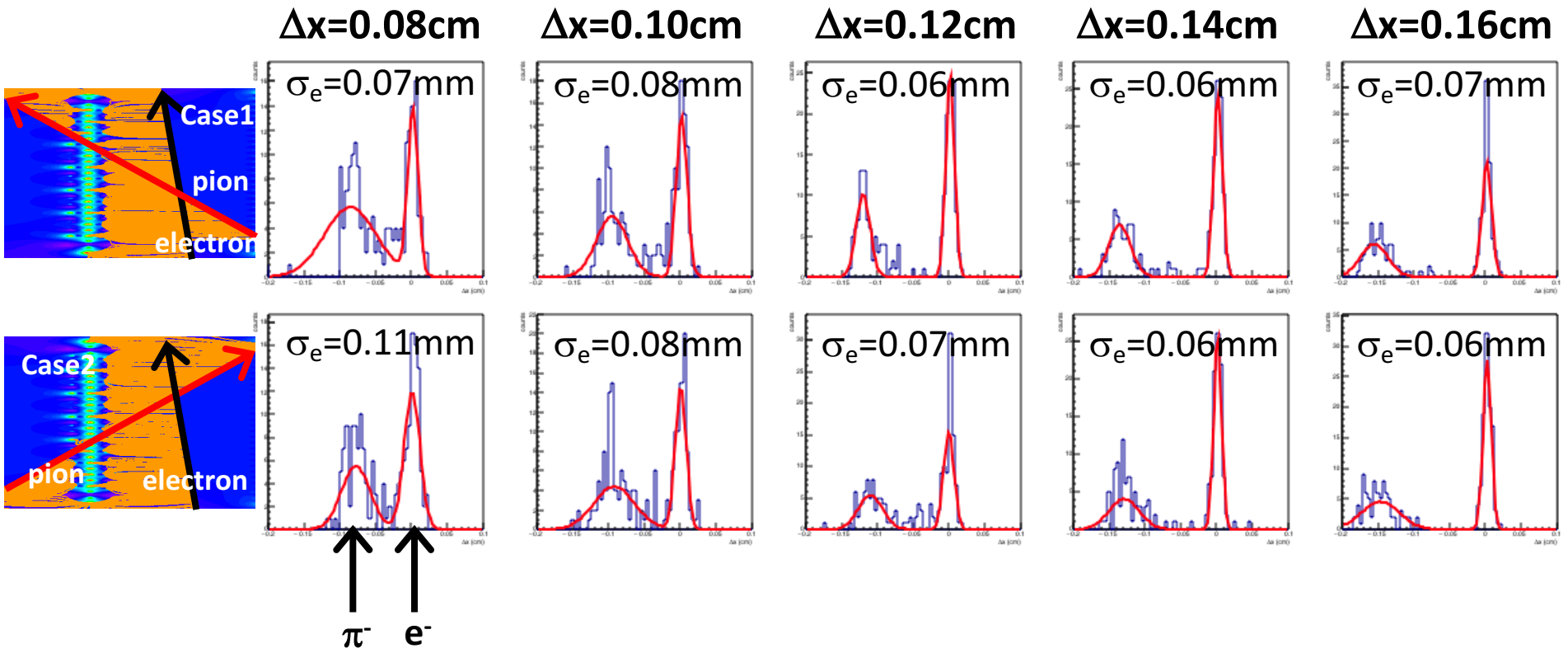




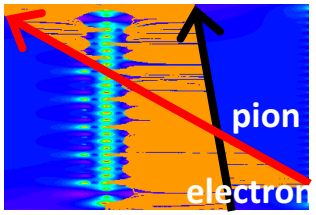


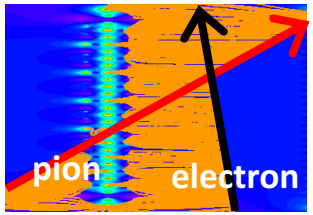
$\Delta(x_e\text{-}x)$

- x_e: true position of electron peak, x: position of electron peak from Gaussian fit
- BG: π, p_T=500MeV
- Distance between e & π: Δx=0.08,0.10,0.12,0.14,0.16cm
- Width of fitted Gaussian for e peak : σ_e<0.1mm



Summary table (BG: π, p_T=500MeV)

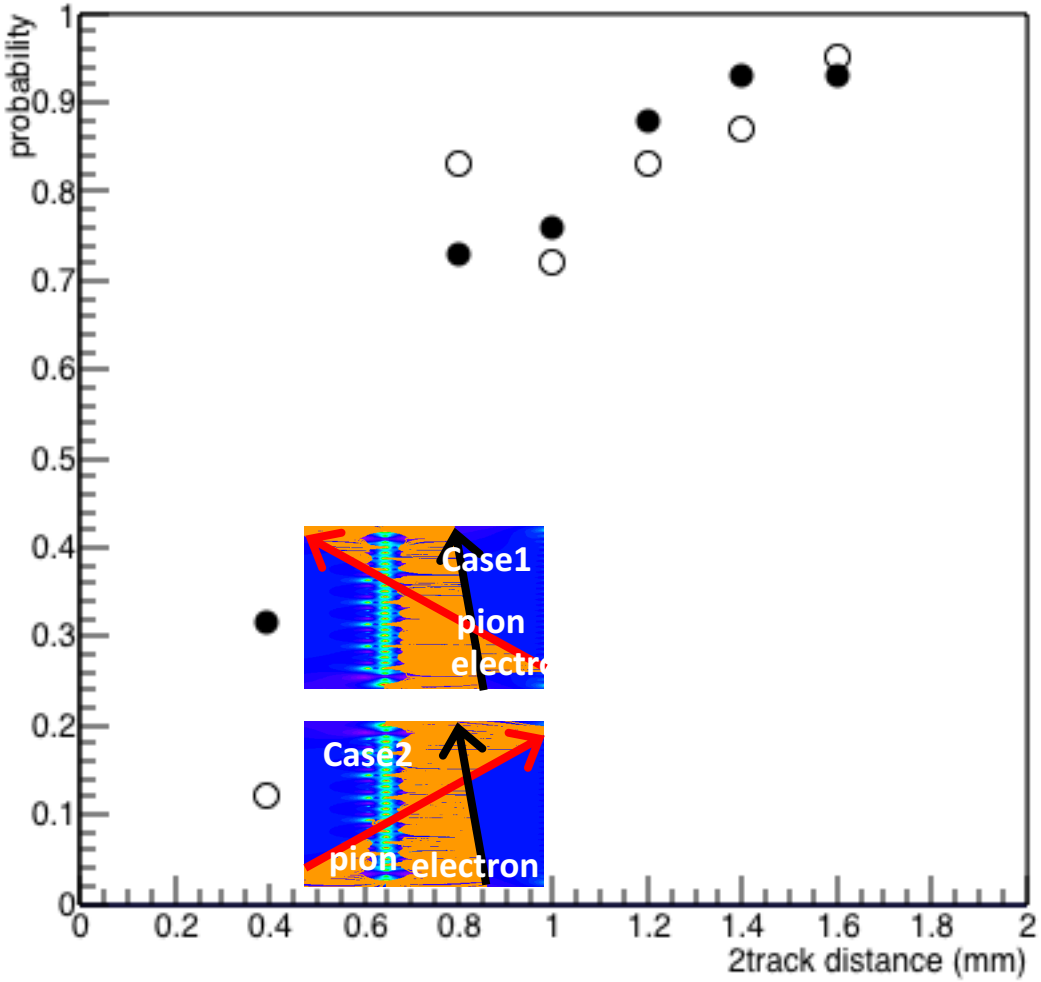
case1 

case2 

	2peaks detected by Tspectrum	1peak detected by Tspectrum	peak width>7ns	peak width≦7ns	$\lvert x_e-x\rvert$<0.2mm	$\lvert x_e-x\rvert$<0.2mm && $\lvert x_{pi}-x\rvert$<0.3mm
Δx=0.08cm	2	98	94	4	73(2)	60
	4	96	93	3	83(2)	69
Δx=0.10cm	18	82	77	5	76(3)	60
	14	86	81	5	72(4)	54
Δx=0.12cm	42	58	50	8	88(8)	59
	21	79	68	11	83(10)	54
Δx=0.14cm	55	45	35	10	93(10)	59
	50	50	38	12	87(10)	54
Δx=0.16cm	69	31	22	9	93(6)	63
	69	31	23	8	95(8)	65

Detection probability of electron peak

- Definition of detection probability of electron peak : events with $\Delta(x_e\text{-}x)<0.2$mm/100 events
- Probability > 0.7 ($\Delta x>0.08$cm with 0.5GeV/c π track)



To-do

- ✧ Simulation with Lorentz angle ON is now ongoing.
  - ✓ Need more time for finding good wire configuration

Drifting electrons from ionization of e & π with Lorentz angle ON